United States Department of the Interior

GEOLOGICAL SURVEY
702 Post Office Building
St. Paul, Minnesota 55101
February 6, 1979

OK

Dr. Richard L. Wade
Director, Division of Environmental Health
Minnesota Department of Health
717 Delaware St. S.E.
Minneapolis, Minnesota 55440

Dear Dr. Wade:

This letter accompanies four copies of a report tabulating information on existing wells in the St. Louis Park area as required by our cooperative agreement.

Additional detailed information on individual wells is available from the U.S. Geological Survey which may be useful to you in your decisions concerning well reconstruction or permanent abandonment. Please contact me if you have questions concerning this or any other aspect of our study.

Sincerely,

FOR THE DISTRICT CHIEF

Marc Hult
Hydrologist

Enclosure

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

INTRODUCTION

The U.S. Geological Survey is conducting a study of drift and bedrock aquifers contaminated by coal-tar in the St. Louis Park area in cooperation with the Minnesota Department of Health. As part of that study, wells which may contribute to the spread of contaminants between aquifers are to be identified for possible reconstruction or abandonment by the Minnesota Department of Health. The purpose of this report is to summarize information obtained to date on the location and construction of such wells. A list of 13 multi-aquifer wells has already been provided to the Minnesota Department of Health.

Approach

Data on wells were initially obtained from the files of the U.S. Geological Survey, the Minnesota Geological Survey, the St. Louis Park Department of Public Works, and previous reports (Sunde, 1974; Barr, 1977). Additional information was obtained from personal interviews with area residents, employees of local businesses, and drillers. Piezometers, sand points, and uncased soil borings are not considered in this report. Only two municipal wells, old St. Louis Park No. 1 and St. Louis Park No. 3 are considered.

The general region of investigation was divided into two areas based on the approximate extent of known contamination in the drift and Platteville limestone (pl. 1). Greatest priority was given to an area immediately surrounding the site in which attempts were made to locate and test all wells. Data for 114 wells are summarized in table 1 and plates 7, 8, and 9. It is assumed that many old abandoned wells remain undetected.

Where possible, water levels and depths of wells were measured and the wells were geophysically logged to verify well construction, stratigraphy and to measure possible vertical flow. These geophysical logs, and other detailed information such as driller's logs, water level measurements, location sketches, and surveying results are available from the U.S. Geological Survey. It was found, however, that the majority of private and industrial wells which were physically located contain obstructions such as pumps, liners or debris which prevent logging and inspection by downhole television camera. Where possible, such obstructions should be removed to permit more complete evaluation and reconstruction or abandonment. Moreover, the well heads of many wells could not be physically located in the field. Excavation or additional field work and interviews will be required to locate such wells. It is assumed that some of these wells will never be located.

The second area of investigation extends beyond the area of known contamination in the glacial drift and Platteville limestone to Golden Valley to the north, Minneapolis to the east, Edina to the south and Hopkins and Minnetonka to the west. The aquifer(s) penetrated and location of wells in this larger area are shown in plates 1, 2, 3, 4, and 5. In this area, only those wells which were identified in previous reports on ground-water contamination in St. Louis Park or which penetrate aquifers below the Jordan Sandstone are listed in table 1.

Although most of these data have been field checked by the U.S. or Minnesota Geological Surveys, no additional effort was made to field check or locate wells in the larger area during this portion of the study. Additional areas for intensive field location of wells may be identified as the study progresses. Periodic water-level measurements are being made and sampling for water quality is anticipated in some of these wells. These wells are identified by the Minnesota Unique Well number and driller's logs are available from the U.S. or Minnesota Geological Surveys.

Potential effect of multiaquifer wells

Uncased or ungrouted wells which penetrate more than one aquifer provide avenues for the transport of contaminants. The effect of an individual well depends on (1) the rate of flow down the well bore, (2) the local and regional ground-water flow patterns on which the well is superimposed and itself modifies, and (3) contaminant concentration.

The rate of flow down the well bore depends primarily on the permeability of the aquifers, the head differences between them, and well construction and condition. For a given well of known original construction, the most difficult factor to estimate is well condition because multiaquifer wells tend to be unstable and casing deteriorates with time.

For example, W23 ("Hinckley" well on the site; figure 1, table 1) was originally constructed so as to permit the flow of water out of the Prairie du Chien-Jordan aquifer and into the underlying Ironton-Galesville and Mt. Simon-Hinckley aquifers. Now, however, water is moving into the Prairie du Chien-Jordan aquifer from the overlying St. Peter aquifer. A down-hole television camera survey and geophysical logging have shown that the well is now 595 feet deep, visibly contaminated, and that water is entering the well bore through leaks in the casing adjacent to the St. Peter sandstone and flowing downward at a rate of approximately 100 gallons per minute. Periodic water-level measurements and a second television survey confirm that this flow is sustained.

A multiaquifer well changes the direction of groundwater flow. A cone of depression is created in the aquifer with the higher head by withdrawal of water from it; conversely, injection of water into the lower aquifer creates a cone of impression. The shape and area of influence of these cones depends on aquifer characteristics and other stresses and boundaries such as pumping wells, other multiaquifer wells, and buried bedrock valleys.

A cone of impression caused at least in part by well W23 occurs in the Prairie du Chien-Jordan aquifer at the site. Static water levels measured by the U.S. Geological Survey on August 23, 1977 at four St. Louis Park municipal wells completed in the Prairie du Chien-Jordan aquifer are shown in figure 1. The water level in well W23 is the water level in the Prairie du Chien-Jordan aquifer at that point and reflects the cone of impression created on the potentiometric surface by water moving through the well bore from the overlying St. Peter aquifer. The water level in well W23 shown on figure 1 was not measured in August 1977, but an estimate was made for this date from 18 measurements since April 1978 and a water level in the spring of 1977 inferred from the Barr report (Phase II, 1977; p.III-34).

The data indicate that water in the Prairie du Chien-Jordan aquifer was moving away from W23 in all directions, but that the gradient was steepest between W23 and the municipal well field to the north. The gradient to the north has decreased since August 1977 in apparent response to the closing of four municipal wells completed in the Prairie du Chien-Jordan aquifer. However, of 27 Prairie du Chien-Jordan aquifer wells measured in St. Louis Park, Edina, and Hopkins on January 30 and 31, 1979, the highest levels were recorded in the 3 wells closest to the site (the "Hinckley" well on the site, W23; Crib Diaper Service, W34; and old St. Louis Park No. 1, W112).

NON-RESPONSIVE

[redacted]

Figure 1.-- Location of creosote plant site in St. Louis Park and well number and water level in Prarie du Chien — Jordan aquifer wells, August 23, 1977

These facts support the conclusion by the Minnesota Department of Health that previous studies indicating that water cannot move from the site to the well fields to the north through the Prairie du Chien-Jordan aquifer may be in error (Health Implications of Polynuclear Aromatic Hydrocarbons in St. Louis Park Drinking Water, Nov. 1978; p. 3).

Other multiaquifer wells on and near the site (notably W105 and W59, table 1) also may be contributing to the potentiometric high and contamination in the Prairie du Chien-Jordan aquifer. Moreover, there exist natural pathways for contaminant transport such as leakage through confining beds and buried bedrock valleys. Adequate prediction of the effects of possible remedial action depends on an understanding of each pathway based on measurements made in the field.

The previous estimate of the direction of ground-water flow cited by the Minnesota Department of Health was based on generalized, regional flow patterns. Description of local flow directions requires actual measurement of water levels in wells which are stress points (pumping wells and multiaquifer wells) and in wells which themselves do not create a significant stress (observation wells).

Well abandonment and reconstruction

Highest priority for well abandonment or reconstruction might be given to those wells which are:

(1) Known to be pathways for contaminant transport; for example, W23.
(2) Nearest the site; proximity to the site is a general indicator of the possible contaminant concentration in the uppermost aquifer. 15 multiaquifer or ungrouted wells penetrating the Prairie du Chien-Jordan aquifer and 18 multiaquifer wells penetrating both the Platteville and St. Peter aquifers are listed in approximate order of distance from site in tables 2 and 3.
(3) Open to deep aquifers; in particular, W105 and W38 are known to penetrate the Mt. Simon-Hinckley aquifer.
(4) Multiaquifer; other nearby, deep wells such as W34, which are ungrouted single aquifer wells may be considered because of possible leakage in the annular space around the casing.

(5) Unused wells presently in use such as W40, W45, W46, and W62 tend to intercept contaminants leaving the area and should be replaced with properly constructed wells before abandonment.

Where possible, wells to be abandoned should be reconstructed into observation wells. This accomplishes three objectives: (1) flow between aquifers is stopped, (2) an observation point is made available to monitor the effectiveness of the reconstruction and evaluation whether flow is occurring in other nearby multiaquifer wells, and (3) data are obtained for descriptive and predictive ground-water modeling. Hydrogeologic cross-sections showing the effect of a Platteville-St. Peter multiaquifer well on the ground-water flow system and conversion of the well into two single-aquifer observation wells are shown in figures 2 and 3.

Nineteen private and industrial wells in the area of intensive investigation have been added to and are now part of the project monitoring network (table 4). Of these, 13 are ungrouted or multiaquifer; the cost of drilling observation wells to replace them is estimated at $130,000. The cost of conversion to observation wells is estimated at $15,000 above the cost of sealing them without provision for monitoring.

As physical access to other wells in the area is obtained, they will be added to the network where feasible. Highest priority should be given those wells which are deepest, and therefore most expensive to replace, and those which are known to have had a significant effect on the flow system.

Table 2--Multiaquifer or ungrouted wells penetrating the Prairie du Chien-Jordan aquifer listed in approximate distance from site.

W 23	Republic "Hinckley" Well (on site)
W105	Minnesota Sugar Beet Co. (on site)
W 29	Flame Industries
W 34	Crib Diaper Service
W 46	Black Top Service - Deep Well
W 49	Strom Block - Deep Well
W112	Old St. Louis Park Well #1
W 38	Milwaukee Railroad Well
W 40	Minnesota Rubber
W 32	Texatonka Shopping Center
W 45, W 46	S & K #1, S & K #2
W 62	McCourtney Plastics
W 74	Lander's Gravel
W 69	Hedberg-Friedheim Block Co.
W107	Interior Elevator Co.
W 70	Park Theatre

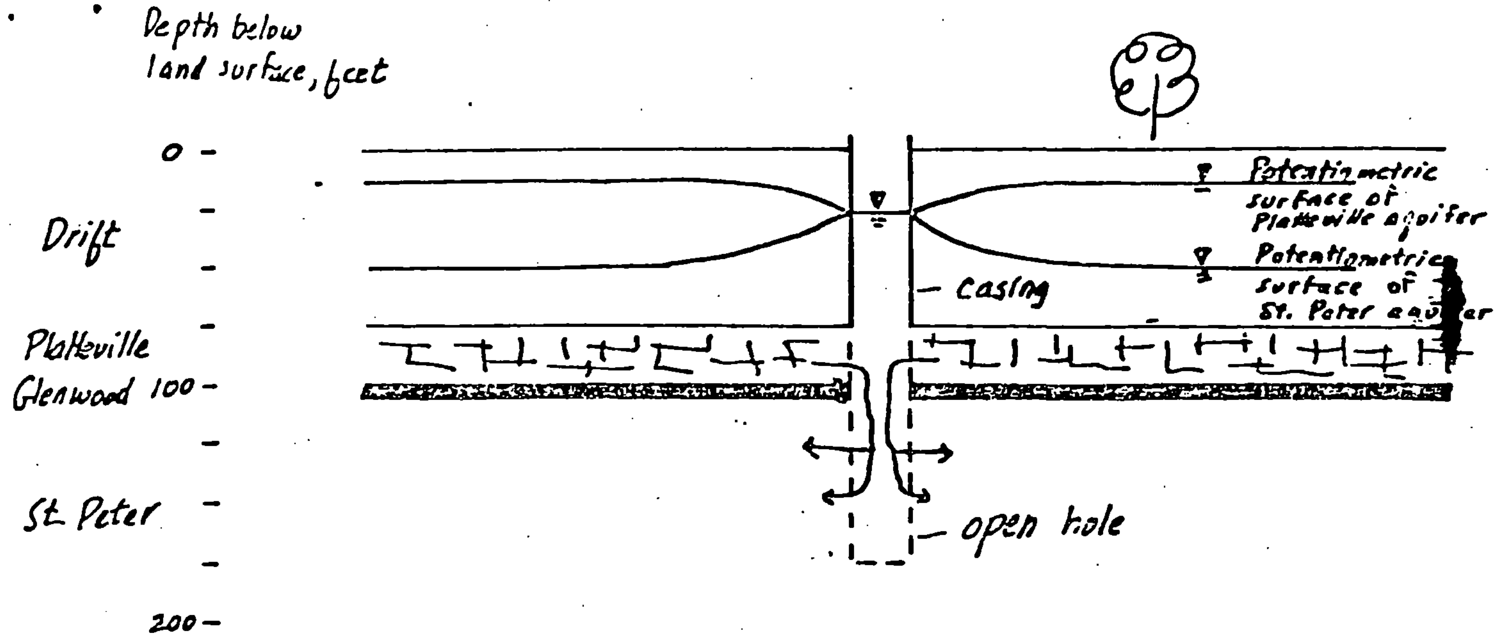


Figure 2.-- Generalized hydrogeologic cross-section showi[ng] a multiaquifer well completed in the St. Peter and Platteville aquifers, flow through the well bore, and th[e] effect of this flow on the potentiometric surfaces o[f] the two aquifers

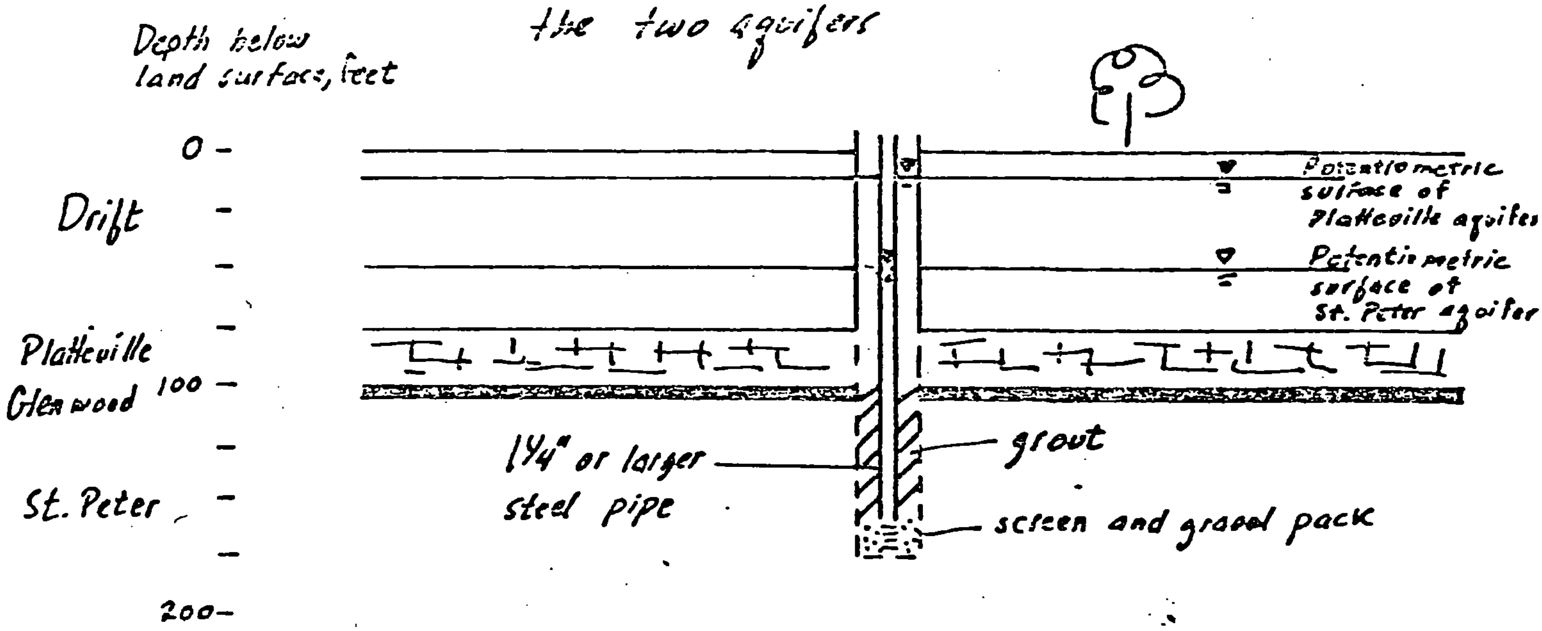


Figure 3.-- Generalized hydrogeologic cross section showing a well originally completed in the St. Peter and Platteville aquifers which has been converted into two single-aquifer observation wells

PAH in Drinking Water .
(Nanograms/Liter)

Well	Depth (feet)	Aquifer	A	P	FI	BaP	BghiPE	OPP	N
SLP #3	236	PSP	< 1.9	< 47	<0.9	<1.1	< 4.4	< 1.1	<10
SLP #4	500	SJ	< 1.9	< 47	4.5	<1.1	< 4.4	< 1.1	<10
SLP #5	465	SJ	< 1.9	< 47	7.4	<1.0	< 4.1	< 1.2	<10
SLP #6	480	SJ	< 1.9	< 47	<1.0	<1.0	< 4.8	< 1.5	<10
SLP #7	446	SJ	11.4	104	7.4	<1.1	< 4.4	< 1.1	<10
SLP #8	507	SJ	< 1.9	< 47	<0.8	<1.1	< 4.4	< 1.1	<10
SLP #9	473	SJ	12.2	199	21.1	<1.1	< 4.4	< 1.1	<10
SLP #10	500	SJ	100	800	450	<1.1	< 9.8	< 2.1	-
SLP #10	500	SJ	54	486	152	1.3	4.4	< 1.2	80
SLP #11	1000	H	< 1.9	< 47	< 0.9	<1.1	< 4.5	< 1.1	<10
SLP #12	1095	H	< 1.9	< 47	< 0.9	<1.1	< 4.5	< 1.1	<10
SLP #13	1040	H	< 1.9	< 47	1.0	<1.1	< 4.5	< 1.2	<10
SLP #13	1040	H	< 1.9	< 47	< 0.9	<1.2	< 4.9	< 1.1	<10
SLP #14	485	SJ	6.3	< 47	4.2	1.8	5.5	2.2	<10
SLP #14	485	SJ	6.3	< 47	2.4	<1.2	5.4	< 1.1	<10
SLP #15	503	SJ	[illegible]	750	390	<1.2	<10.7	< 2.4	-
SLP #15	503	SJ	241	1221	292	1.5	6.8	2.0	160
SLP #16	500	SJ	< 1.9	< 47	< 0.8	<1.1	< 4.4	< 1.1	<10
Edina #2	460	SJ	< 1.9	< 47	3.1	<1.1	< 4.6	< 1.1	<10
Edina #3	475	SJ	< 1.9	< 47	1.0	<1.1	< 4.6	< 1.1	<10
Edina #4	495	SJ	< 1.9	< 47	0.9	<1.1	< 4.6	< 1.1	<10
Edina #7	547	SJ	< 1.9	< 47	<0.8	<1.1	< 4.7	< 1.1	<10
Edina #15	405	SJ	< 1.9	< 47	<0.8	<1.1	< 4.6	< 1.1	<10
Edina #17	461	SJ	< 1.9	< 47	<0.8	<1.1	< 4.7	< 1.1	<10
R #1	624	SJ	< 1.9	< 48	2.8	< 1.2	< 4.9	< 1.1	<10
R #2	624	SJ	< 1.9	< 47	2.1	<1.2	< 4.9	< 1.1	<10
R #4	402	SJ	< 1.9	< 47	0.9	<1.2	< 4.9	< 1.1	<10
WBL #3	289	SJ	< 1.9	< 48	<1.0	<1.0	< 5.1	< 1.6	<10
F #13	332	SJ	< 1.9	< 48	1.5	<1.2	< 6.3	< 2.0	<10
Edina P #1	-	-	< 1.8	< 45	2.1	<0.8	5.6	< 1.2	<10
Edina P #2	-	-	< 1.8	< 45	1.2	<0.8	< 3.4	< 1.2	<10

2. Dates of Well Closures

(a) Well 7 - September 29, 1978 (last run)

Well 9 - September 29, 1978 (last run)

Well 10 - November 10, 1978

Well 15 - November 10, 1978

Well 4 - November 20, 1979

(b) Reasons for Well Closures:

During the period May 8 - August 9, 1978, water samples were analyzed for seven polynuclear aromatic hydrocarbons (anthracene, pyrene, fluoranthene, benzo(a)pyrene, benzo (ghi) perylene, o-phenylenepyrene, and naphthalene) for municipal wells serving St. Louis Park, Edina, Robbinsdale, White Bear Lake, Fridley, for four private wells in Edina, and for the Glenwood-Inglewood well in Robbinsdael. Samples were analyzed using High Performance Liquid Chromatography (HPLC), and positive results for pyrene, fluoranthene, anthracene, and naphthalene were confirmed by gas chromatography/mass spectrometry. Wells 10 and 15 were found to be most heavily contaminated and wells 7 and 9 were less heavily contaminated. All of these wells are Prairie du Chien-Jordan wells. Levels for pyrene, fluoranthene, anthracene, and naphthalene were well above detection limits, while levels for benzo (a) pyrene, benzo (ghi) perylene, and o-phenylenepyrene were just above detection for St. Louis Park wells 7, 9, 10, and 15. Please refer to Table 1 for specific values. These four wells were closed because the potential intake of PAH compounds by St. Louis Park residents via water supply would be significantly increased over other sources (i.e. dietary). Secondly, the only standards on PAH levels in water at the time were World Health Organization standards, setting a level of 200 ng/l for the sum of six PAH compounds, including fluoranthene.

Well #4 was closed in the Autumn of 1979, because of the appearance of acenaphthalene, biphenyl, fluoranthene, phenanthrene, and benzo(a)pyrene during October and November samplngs. Please refer to Table 2 for analytical data.

(c) Well 4 was pumped on May 1 (311,000 gallons), May 3 (264,000 gallons), and May 5 (244,000 gallons) of 1980 in order to provide adequate pressure in the distirbution system of St. Louis Park for fire protection.

Wells 7, 9, 10, and 15 have never been in service. Well 15 has provided water to analyze the effectiveness of powdered activated carbon slurry treatment. Tests were conducted during July and October of 1979. All waters from Well 15 were discharged to wastes.

(d) Well 4 was placed into service because the City was facing a low-pressure condition in the distribution system in the southeast corner of St. Louis Park. This condition presented a particular problem in providing adequate fire protection. The well was operated on three (3) separate days.

3. (a) A brief study was conducted on treatment of contaminated water utilizing a small-scale, pilot treatment plant using powdered activated carbon (PAC) Tests were conducted during July (7/16/79 - 7/20/79) and October (10/2/79) of 1979.

(b) Powdered activated carbon (PAC) served as a media for absorption of PAH compounds. PAC was mixed with water to form a slurry, which was then pumped into the well head of well 15. The well was pumped at 1000 gpm. PAC levels of 1-2 mg/l, 4-5 mg/l and 9-12 mg/l were analyzed. PAC was removed on sand filters and the waters discharged to waste.

(c) The treatment studies conducted to date have indicated strong removal of PAH compounds, and have been very encouraging. Reductions of greater than an order of magnitude have been found, particularly for PAC concentrations of 9-12 mg/l. However, some of the results have been erratic and clearly a well-structured and intense study is required to determine the long-term effectiveness of the treatment system.

(d) The treatment studies have not had any impact on the water supply to date. The studies that were conducted were preliminary and further work is required before allowing treated water into the distribution system. The waters pumped from well 15 have been discharged to waste following treatment and sampling. Water from wells 7, 9, 10, 15, have never been used for supply and from well 4 for a brief period in early May.

NON-RESPONSIVE

[redacted]

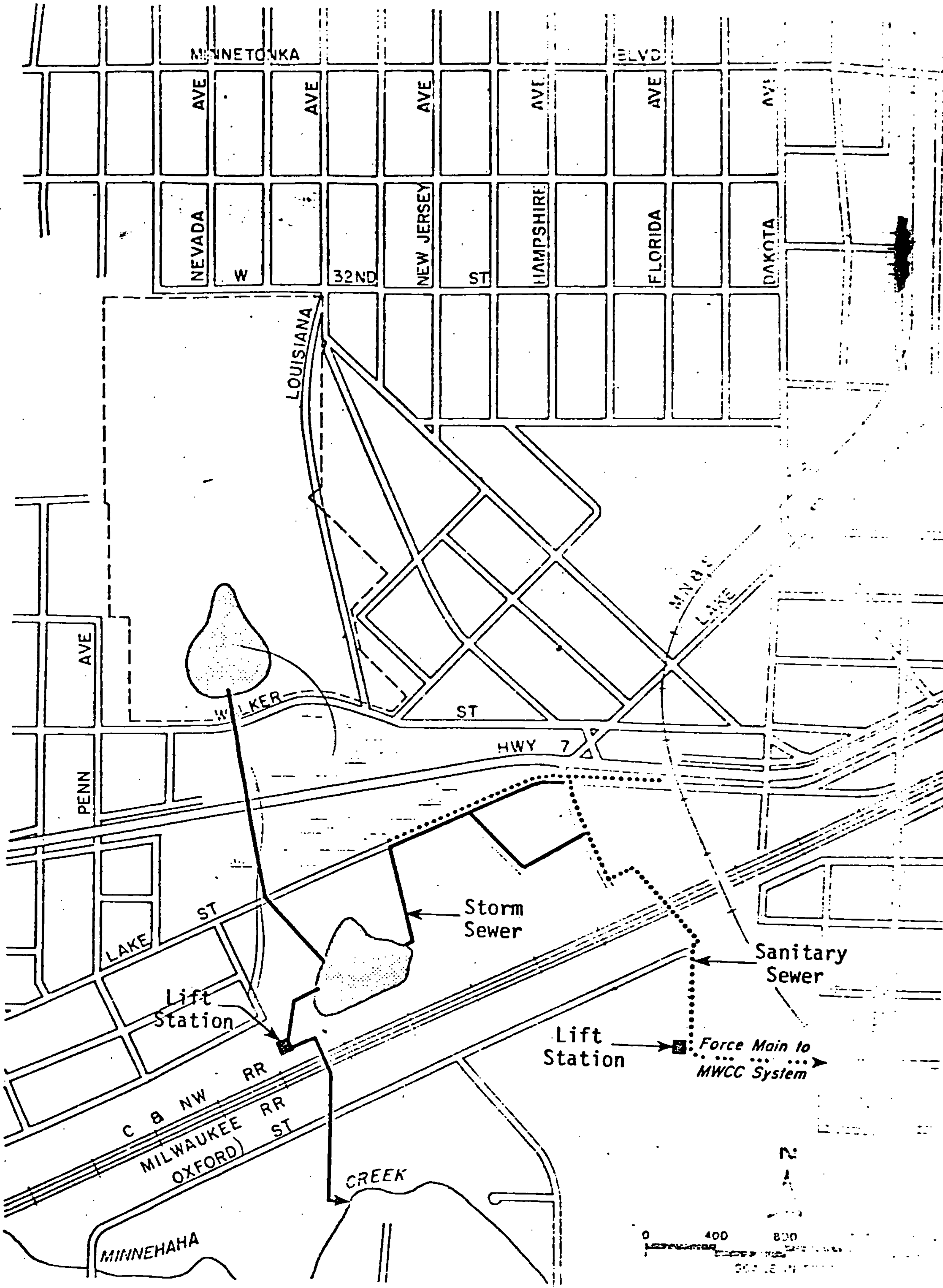


FIGURE 24

EXISTING STORM SEWER AND SANITARY SEWER SYSTEMS

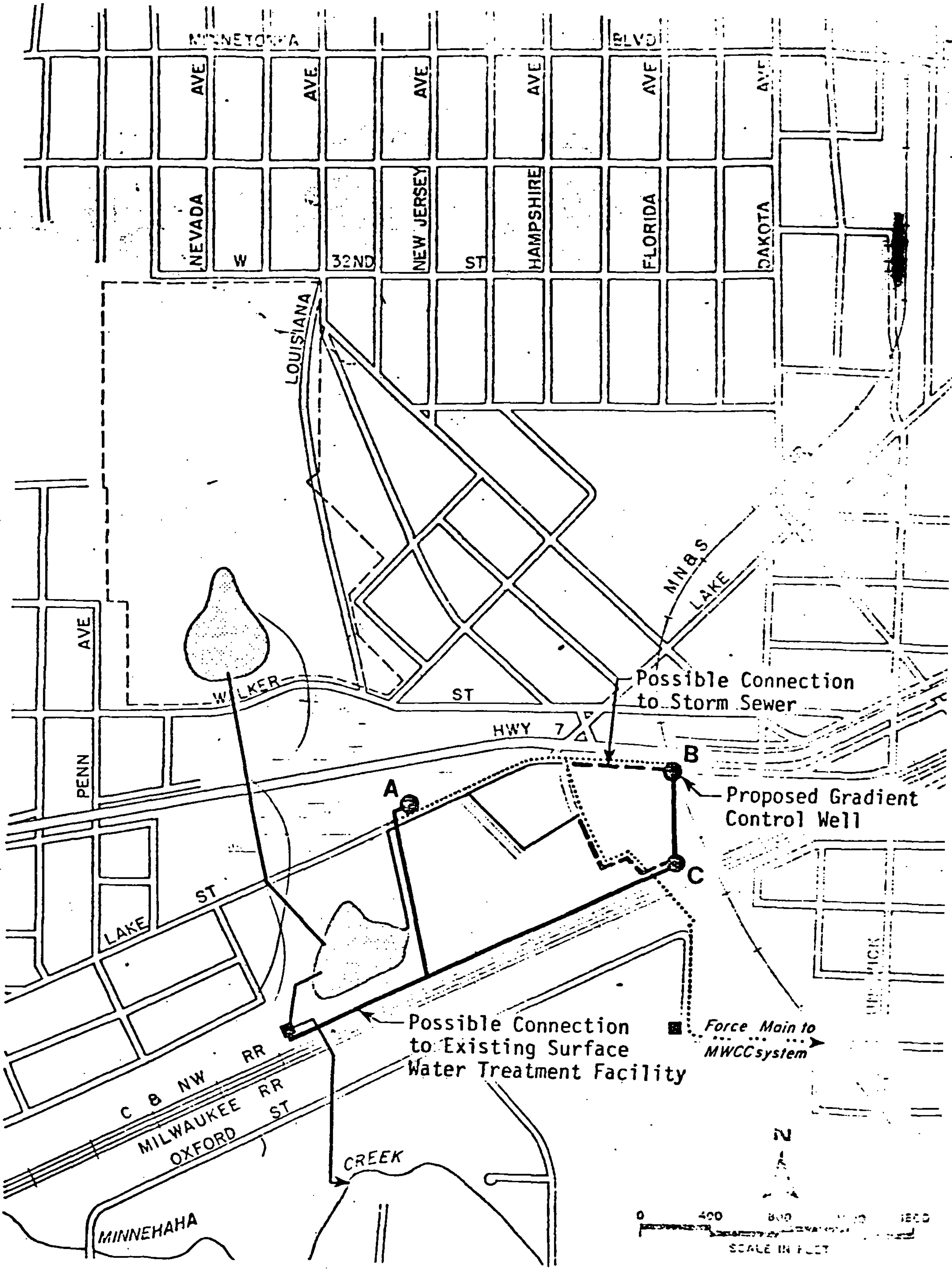
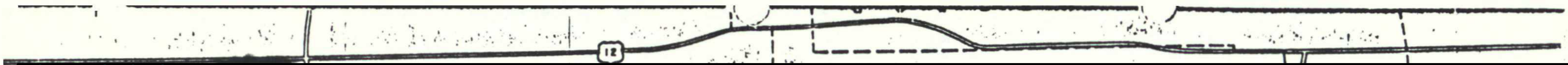


FIGURE 25

ALTERNATIVE GRADIENT CONTROL SYSTEMS

NON-RESPONSIVE

[redacted]



NON-RESPONSIVE

[redacted]

11	St. Louis Park Well #3	23	Minnetonka Well #11
12	St. Louis Park Well #15	24	Minnetonka Well #12
13	St. Louis Park Well #5		

FIGURE 11

BOUNDARY CONDITIONS USED IN MODELING OF
ST. PETER-PRAIRIE DU CHIEN AQUIFERS

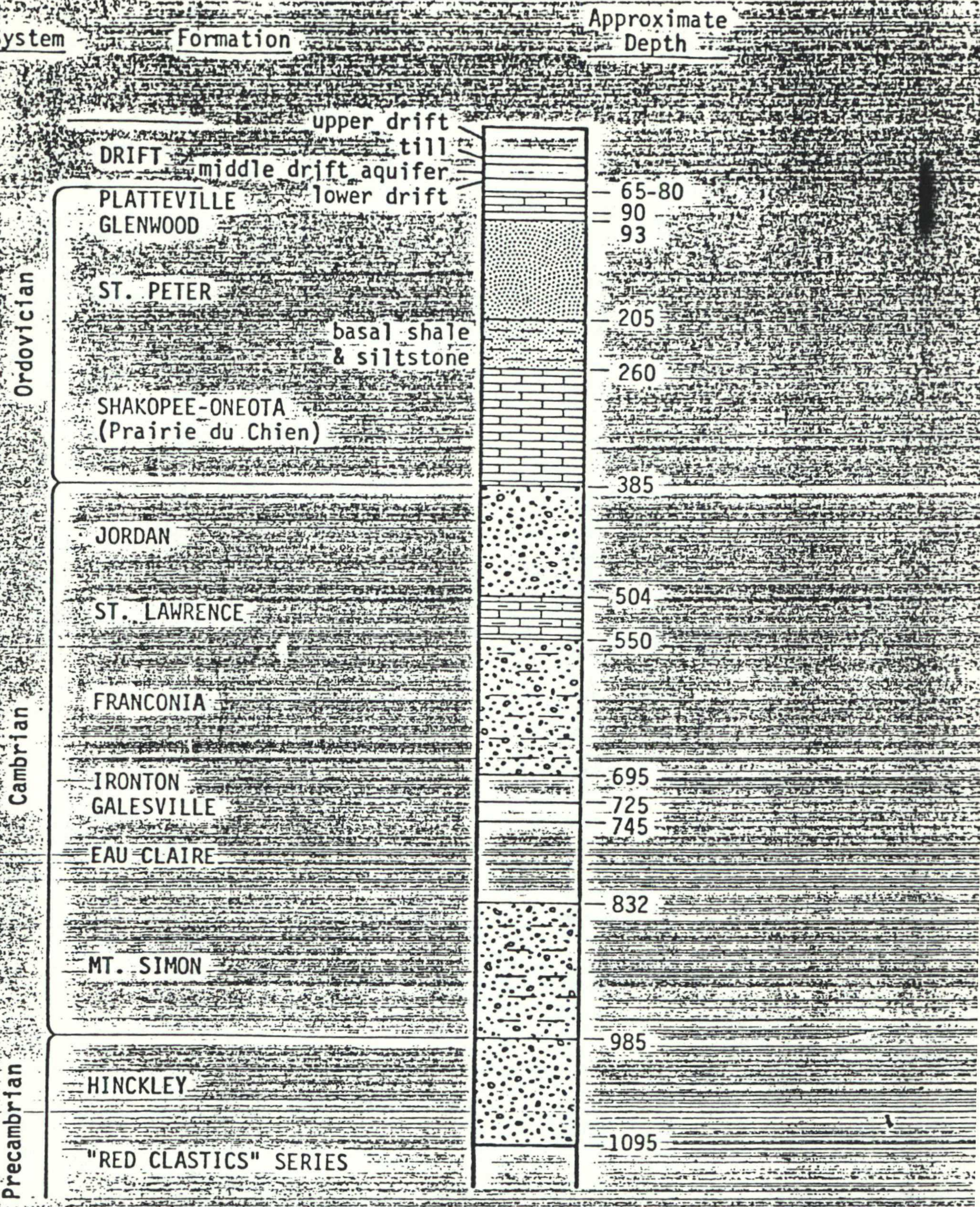


FIGURE 5

GENERALIZED GEOLOGIC COLUMN

Adopted from Sunde, Hydrogeologic Study of the Republic Creosote Site (1974).

TABLE 9

MWCC LIMITATIONS FOR
DISCHARGES TO THE SANITARY SEWER*

Substance or Characteristic	Limit
Cadmium, mg/l	2.0
Chromium (total), mg/l	25.0
Chromium (hexavalent), mg/l	10.0
Copper, mg/l	5.0
Cyanide (total), mg/l	10.0
Cyanide (readily released at 150°F and pH = 5.5), mg/l	2.0
Iron, mg/l	50.0
Lead, mg/l	0.5
Mercury, mg/l	None at levels acutely toxic to humans or other animals or plant life.
Nickel, mg/l	10.0
Zinc, mg/l	15.0
Temperature (except where higher temperatures are required by law), °F	≤150
pH, units	5.5-9.5
Oil and Grease (hexane soluble), mg/l	100

*Source: "Sewage and Waste Control Rules and Regulations for the Metropolitan Disposal System," Metropolitan Sewer Board, December 1, 1971.

TABLE 10

STANDARDS FOR DISCHARGES OF STORM WATER FROM SITE TO MINNEHAHA CREEK[a]

Substance or Characteristic	Permissible Concentration With Dilution		Permissible Daily Maximum Concentration
Oil and Grease, mg/l	0.5x[b]		15
Phenols, mg/l	0.01x		0.1
5-Day Biochemical Oxygen Demand, mg/l	5x		45
Total Suspended Solids, mg/l	5x		45
Total Chlorine Residual, mg/l	0.01x		0.2
Zinc, mg/l	0.12x		1.0
Cadmium, mg/l	0.03x		0.2
Copper, mg/l	0.01x		0.5
Nickel, mg/l	0.52x		2.0
Lead, mg/l	0.03x		1.0
Ammonia, mg/l as N	1.0x		2.0
Benzo-α-pyrene, mg/l	--	10ppt	0.00001
Chrysene, mg/l	--	10ppt	0.00001
pH, units	--		6.5 8.5

[a] Source: NPDES Permit No. MN 0045489. Refer to permit for additional detail.

$$^{b}x = \frac{(0.25)(\text{flow in Minnehaha Creek})+(\text{effluent flow rate})}{(\text{effluent flow rate})}$$

Flows used in calculation of dilution ratio "x" shall be the daily total effluent flow rate and the daily total flow rate Minnehaha Creek.

ST. LOUIS PARK
PILOT CARBON TREATMENT STUDY
JULY 16-20, 1979
WELL NUMBER 15
MINNESOTA DEPARTMENT OF HEALTH's RESULTS

SERCO Laboratories January 9, 1980

Test Condition	Partial List of Parameters (ng/l)					
	Acenapthene	Anthracene	Phenanthrene/Pyrene*	Fluorene	Fluoranthene	Chrysene
Untreated Samples						
7/16 11:00 AM	3200	-	1700	-	510	<25
7/18 11:00 AM	2400	-	1800	-	440	<25
7/19 5:00 AM	2800	-	1900	-	380	<25
7/20 5:00 AM	<2.2	60	1400	-	190	-
Post Sand-Filter Untreated						
7/16 11:05 AM	<140	-	6.1	-	3.6	<25
7/16 11:00 PM	2500	-	1900	-	84	<25
7/16 5:00 PM	1600	-	440	-	91	<25
7/19 3:00 AM	4800	-	1100	-	32	<25
7/19 3:00 AM (Dupl.)	3900	-	1000	-	32	<25

* co-eluting compounds
< means "less than"

ST. LOUIS PARK
PILOT CARBON TREATMENT STUDY
JULY 16-20, 1979
WELL NUMBER 15
MINNESOTA DEPARTMENT OF HEALTH's RESULTS

SERCO Laboratories — January 9, 1980

Test Condition	Acenapthene	Anthracene	Phenanthrene/Pyrene*	Fluorene	Fluoranthene	Chrysene
	Partial List of Parameters (ng/l)					
Post Sand-Filter Treated, 1-2 mg/l						
7/17 11:00 AM	910	-	430	-	89	<25
7/17 11:00 AM (Dupl.)	1200	-	360	-	81	<25
7/17 5:00 PM	1300	-	300	-	62	<25
7/17 11:00 PM	170	<8.0	180	-	39	<25
7/17 11:00 PM (Dupl.)	2700	-	190	-	30	<25
7/18 5:00 AM	1500	-	180	-	28	<25
7/18 11:00 AM	2600	-	210	-	41	<25
7/18 5:00 PM	190	<8.0	210	-	17	-
7/18 9:00 PM	190	<8.0	240	-	15	-

* co-eluting compounds
< means "less than"

TABLE 1

ST. LOUIS PARK
PILOT CARBON TREATMENT STUDY
JULY 16-20, 1979
WELL NUMBER 15
MINNESOTA DEPARTMENT OF HEALTH's RESULTS

SERCO Laboratories January 9, 1980

Test Condition	Partial List of Parameters (ng/l)					
	Acenapthene	Anthracene	Phenanthrene/Pyrene*	Fluorene	Fluoranthene	Chrysene
Post-Sand Filter Treated, 9-12 mg/l						
7/19 5:00 AM	110	<8.0	510	-	14	<25
7/19 11:00 AM	21	<8.0	10	-	7.0	-
7/19 5:00 PM	<2.2	<8.0	27	-	3.6	-
7/19 11:00 PM	<2.2	<8.0	<1.0	-	1.0	-
7/20 5:00 AM	<2.2	<8.0	<1.0	-	1.2	-
May-August 1978	-	190	750[1]	-	390	-
	-	241	1221[1]	-	292	-

* co-eluting compounds

[1] Pyrene only

< means "less than"

INTER-OFFICE MEMORANDUM

Dick Koppy DATE July 10, 1979

Vern Tollefsrud

ECT Pilot Study - Carbon Treatment of Well Water Deep Well #15

On July 11, 1979, a meeting was held at the St. Louis Park City Hall. In attendance were Dick Koppy, Director of Public Works; Vern Tollefsrud, Water Superintendent; Bill Scruggins, Minnesota Health Department; Larry Briemhurst, Serco Labs and Darrel Thingvold of Serco.

The testing should begin on Monday, July 16, 1979. There will be two separate runs at different settings for the addition of the powdered carbon.

The M.H.D. will take about 20 to 25 samples.

Serco Laboratories will take about 7-10 samples plus P.H. and S.S. and temperature samples.

Some of these samples will be split samples. There will be two runs conducted. The first run will be with a projected 5 P.P.M. of carbon added to 1,000 G.P.M. of water. Sampling will be as follows:

First Run -- 5 P.P.M.

1. Raw water at Pump Head
2. Raw water effluent after filters
3. Six hour intervals for 48 hours of water effluent
4. Six hour intervals for 48 hours of suspended solids - carbon
5. Six hour intervals for 48 hours of temperature and P.H.
6. Backwash sample - composite of several cells.
7. Record pressure differentials in filter banks

Second Run -- 25 P.P.M.

1. Raw water at Pump Head
2. Raw water effluent after filters
3. Six hour interval for 48 hours of water effluent
4. Six hour intervals for 48 hours of suspended solids - carbon
5. Six hour intervals for 48 hours of temperature and P.H.
6. Backwash sample - composite of several cells.
7. Record pressure differentials in filter banks.

All effluent to be run into storm sewer system.
Turn around time for reading of samples about one week
Sample size to be 4 litre

If a third run is necessary to fine tune the application of carbon slurry, the same sampling times would be used.

A post testing meeting will be held at City Hall to review the results of this testing and further testing, using new carbon concentrations, may be conducted

Carbon Costs - $0.42 per pound
Samples Serco - $100.00 per sample - approximate
Deep Well #15 - Pumping 1,000 G.P.M.

Coordination of sampling and runs will be by Vern Tollefsrud

jme

CARBON TREATMENT PROCEDURES

1. Initial test run to be at least six days.

2. Set up equipment series 44 W & T slurry feeder

   slurry pump) - slurry mixer - flush lines - etc.
   slurry tank)

3. Start with initial dosage of 5 P.P.M.

   Recommended by Dr. Russ Frazier S.B.H. - may need more or less P.A.C.

4. Take sample after sand filter is completely purged.

   First sample about two hours into run

5. Take samples on set times - State Board of Health

   Samples to be taken at well head and after filtering.
   Bill Scrugging S.B.H. to do samples and timing of samples to be taken

6. Decrease or increase dosage to reach desired results.

   P.A.C. added or decreased as needed to bring P.A.H. into acceptable limits.

Federal regs on PAH may be out in June or July

Preliminary, Subject to Revision

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Minn. Dept. of Health
Div. of Env. Health

Table 3.—Summary of ground-water use in the St. Louis Park area, Minnesota

Site identification (latitude and longitude)	Aquifer	Well name	Date of instal-lation	Period of monthly pumpage records	Pump capacity (gal/min)	1976 Total reported pumpage, summary (gallons)
		INDUSTRIAL WELLS				
445615093212301	Prairie du Chien-Jordan	Minnesota Rubber (W40)	8/50	1968-78	300	81,778,840
445604093223801	Prairie du Chien	Flame Industries (W29)	4/63	1968-78	100	11,923,868
445618093210001	St. Peter-Prairie du Chien	S & K Products #1(W45)	7/63	1968-78	175	Not in use
445617093210201		#2(W46)	2/73	1973-78	175	6,582,000
445646093214601	Prairie du Chien-Jordan	Methodist Hospital	1958	1973-78	---	228,170,300
445721093221601	St. Peter-Prairie du Chien	McCourtney Plastics (W62)	9/66	1975-78	250	59,976,131
445733093214301	Prairie du Chien	Food Producer	---	1969-78	---	66,281,040
445608093240301	Prairie du Chien-Jordan	Red Owl	10/46	1973-78	---	81,752,286
		ST. LOUIS PARK MUNICIPAL WELLS				

NON-RESPONSIVE

[redacted]

PRELIMINARY
Subject to Revision

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Minn. Dept. of Health
Div. of Env. Health

NON-RESPONSIVE
[redacted]

EDINA MUNICIPAL WELLS

NON-RESPONSIVE
[redacted]

HOPKINS MUNICIPAL WELLS

NON-RESPONSIVE
[redacted]

Record pressure differentials on sand filters.

To be sure that filters are operating at peak efficiency and as to how fast P.A.C. builds up on the filters.

8. Backwash when differential reaches #4 - #6 or the maximum time of 10 days.

9. All affluent shall be pumped to waste until given permission by the Health Department to place plant back into operation.

   It may require us to have more than one test run of two days or more.

Aquifer	A	P	Fl	BaP	BghiPE	oPP	N
-	< 1.8	<45	2.3	<0.8	3.9	< 1.2	< 10
-	< 1.8	<45	< 0.8	<0.8	< 3.4	< 1.2	< 10
-	< 1.9	<47	< 0.9	<1.2	6.8	1.6	< 10
-	< 7.0	<210	9.3	<3.6	<13.0	< 1.7	-
-	< 7.0	<210	4.7	<3.6	<13.0	< 1.7	-

ction limit, A = anthracene, P = pyrene, Fl = fluoranthene,
, BghiPe = benzo[ghi]perylene, oPP = o-phenylenepyrene,
, R = Robbinsdale, F = Fridley, WBL = White Bear Lake,
. Peter, SJ = Shakopee-Jordan, H = Hinkley

PAH in Drinking Water .
(Nanograms/Liter)

Well	Depth (feet)	Aquifer	A	P	FI	BaP	BghiPE	OPP	N
SLP #3	236	PSP	< 1.9	< 47	<0.9	<1.1	< 4.4	< 1.1	<10
SLP #4	500	SJ	< 1.9	< 47	4.5	<1.1	< 4.4	< 1.1	<10
SLP #5	465	SJ	< 1.9	< 47	7.4	<1.0	< 4.1	< 1.2	<10
SLP #6	480	SJ	< 1.9	< 47	<1.0	<1.0	< 4.8	< 1.5	<10
SLP #7	446	SJ	11.4	104	7.4	<1.1	< 4.4	< 1.1	<10
SLP #8	507	SJ	< 1.9	< 47	<0.8	<1.1	< 4.4	< 1.1	<10
SLP #9	473	SJ	12.2	199	21.1	<1.1	< 4.4	< 1.1	<10
SLP #10	500	SJ	100	800	450	<1.1	< 9.8	< 2.1	-
SLP #10	500	SJ	54	486	152	1.3	4.4	< 1.2	80
SLP #11	1000	H	< 1.9	< 47	< 0.9	<1.1	< 4.5	< 1.1	<10
SLP #12	1095	H	< 1.9	< 47	< 0.9	<1.1	< 4.5	< 1.1	<10
SLP #13	1040	H	< 1.9	< 47	1.0	<1.1	< 4.5	< 1.2	<10
SLP #13	1040	H	< 1.9	< 47	< 0.9	<1.2	< 4.9	< 1.1	<10
SLP #14	485	SJ	6.3	< 47	4.2	1.8	5.5	2.2	<10
SLP #14	485	SJ	6.3	< 47	2.4	<1.2	5.4	< 1.1	<10
SLP #15	503	SJ	[illegible]	750	390	<1.2	<10.7	< 2.4	-
SLP #15	503	SJ	241	1221	292	1.5	6.8	2.0	160
SLP #16	500	SJ	< 1.9	< 47	< 0.8	<1.1	< 4.4	< 1.1	<10
Edina #2	460	SJ	< 1.9	< 47	3.1	<1.1	< 4.6	< 1.1	<10
Edina #3	475	SJ	< 1.9	< 47	1.0	<1.1	< 4.6	< 1.1	<10
Edina #4	495	SJ	< 1.9	< 47	0.9	<1.1	< 4.6	< 1.1	<10
Edina #7	547	SJ	< 1.9	< 47	<0.8	<1.1	< 4.7	< 1.1	<10
Edina #15	405	SJ	< 1.9	< 47	<0.8	<1.1	< 4.6	< 1.1	<10
Edina #17	461	SJ	< 1.9	< 47	<0.8	<1.1	< 4.7	< 1.1	<10
R #1	624	SJ	< 1.9	< 48	2.8	<1.2	< 4.9	< 1.1	<10
R #2	624	SJ	< 1.9	< 47	2.1	<1.2	< 4.9	< 1.1	<10
R #4	402	SJ	< 1.9	< 47	0.9	<1.2	< 4.9	< 1.1	<10
WBL #3	289	SJ	< 1.9	< 48	<1.0	<1.0	< 5.1	< 1.6	<10
F #13	332	SJ	< 1.9	< 48	1.5	<1.2	< 6.3	< 2.0	<10
Edina P #1	-	-	< 1.8	< 45	2.1	<0.8	5.6	< 1.2	<10
Edina P #2	-	-	< 1.8	< 45	1.2	<0.8	< 3.4	< 1.2	<10

<Table 2>

TABULATION SHEET

TOPIC: St. Louis Park Municipal Wells.

NON-RESPONSIVE

[redacted]